PATTERN OF INTRAFAMILIAL SPREAD OF CHOLERA

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INTRODUCTION

Bangladesh was primarily a seat of Classical cholera until 1972. Many studies (1, 2, 3, 4, 5 and 6) have been conducted on Classical cholera. The findings of the El Tor cases (five) of Chittagong, Bangladesh, were more or less similar to the findings obtained abroad. With the introduction of El Tor, the former observations (5, 7 and 8) on El Tor appeared different in Dacca.

We, therefore, initiated a ten-day family study of El Tor cholera cases to delineate the secondary infection rates, secondary case rates, infection-to-case rates, infection-to-hospitalization rates, multiple-case family rates, age and sex differentials and index-specific secondary infection rates in contact of El Tor cases of Dacca.

METHODS

Over a period of time the Cholera Research Laboratory (CRL) has been the principle facility for treating all diarrhoea cases occurring in and around Dacca. The cases were selected from the CRL ward on the basis of having a family living with the index case in the city area, was willing to co-operate and have had a short history of untreated diarrhoea which yeilded El Tor biotype of *Vibrio cholerae* on rectal swab culture. The families were visited by the field teams on the morning following admission, for collection of data on age, sex, number of members and history of illness.

The family members were visited daily, were asked about diarrhoeal illness, and rectal swabs were obtained for culture. The swabs were first streaked on Monsur's plate (TTGA) and then placed in bile peptone media. The culture was done in the CRL, using standard technique.

The first case of a family admitted into the hospital was defined as an index case. A contact yielding vibrio on culture was termed an infection. An infected contact, having three or more loose motions in a day, was a case and an infection without sysmptoms, an inapparent infection. Members living together and eating from the same cooking pot, formed a family.

RESULTS

Table 1 shows that the attack rates for male and female are 56% and 28%, respectively, below the age of five. In the following groups also, males have higher infection rates than females. The overall rate is 31.3%.

Table 2 shows the case rates in all contacts, case rates in infected persons and infection-to-hospitalisation ratio. The overall case rate is 24.6% and the infection-to-case conversion rate is 78.6%. Out of thirteen infected children, in the 0 ~ 4 year age group, only one needed hospitalisation. For the older groups, one out of every five needed hospitalization. In all, for one hospitalized case there are 4.1 cases and 5.2 infections.

Figure 1 shows the duration of excretion of vibrio by index cases, by secondary cases

Table 1

Pattern of Intrafamilial Spread of Cholera (El Tor)
Age: Sex: and Infection Rate of Contacts

AGE	MALE			FEMALE			
	Contact CT	Infection	Rate/100	Contact	Infection	Rate/100	Total/100
0–4	16	9	56.2	14	4	28.6	43.3
5–9	17	8	47.0	12	3	25.0	38.0
10+	28	9	32.1	47	9	19.1	24.0
TOTAL	61	26[a]	43.3	73	16[b]	22.0	31.3

a vs b = Significant

Table 2

Infection Rates, Case Rates, Infection to Case Rates and Infection: Hospital Ratio in Contacts

Age	Contact	Infec/100	Case/100	Case/100 Infection	Infn: Hosp. Ratio
0–4	30	13 (43.3)[a]	11 (36.7)[c]	84.6	11:1
5–9	29	11 (37.9)	9 (31.0)	81.8	5.5:1
10+	75	18 (24.7)[b]	13 (17.8)[d]	72.2	5:1
TOTAL	134	42 (31.3)	33 (24.6)	78.6	5.2:1

a vs b $X^2 = 2.97$ c vs d $X^2 = 3.51$

Table 3

Family Size, Children Population & Infection

Family Size (Index Excluded)	Percent of Children	Secondary Infection/100	Secondary Case/100
Up to 4	9.8[a]	17.0[b]	9.8[f]
5–6	69.8[b]	41.9[e]	39.5[g]
7 & over	52.0[c]	34.0	24.0
TOTAL	44.8	31.3	24.6

a vs b = Significant
a vs c = Significant
d vs e = Significant
f vs g = Significant

and by inapparent infections: over 35% of all excrets for one day, nearly 20% for two days, 10% for four days and 1.5% for eight days. The average for the index, including one day with symptoms before admission, is 4.24 days; secondary case, 2.9 days; and symptomless infections for 1.4 days. All the index cases, however, used antibiotics during treatment.

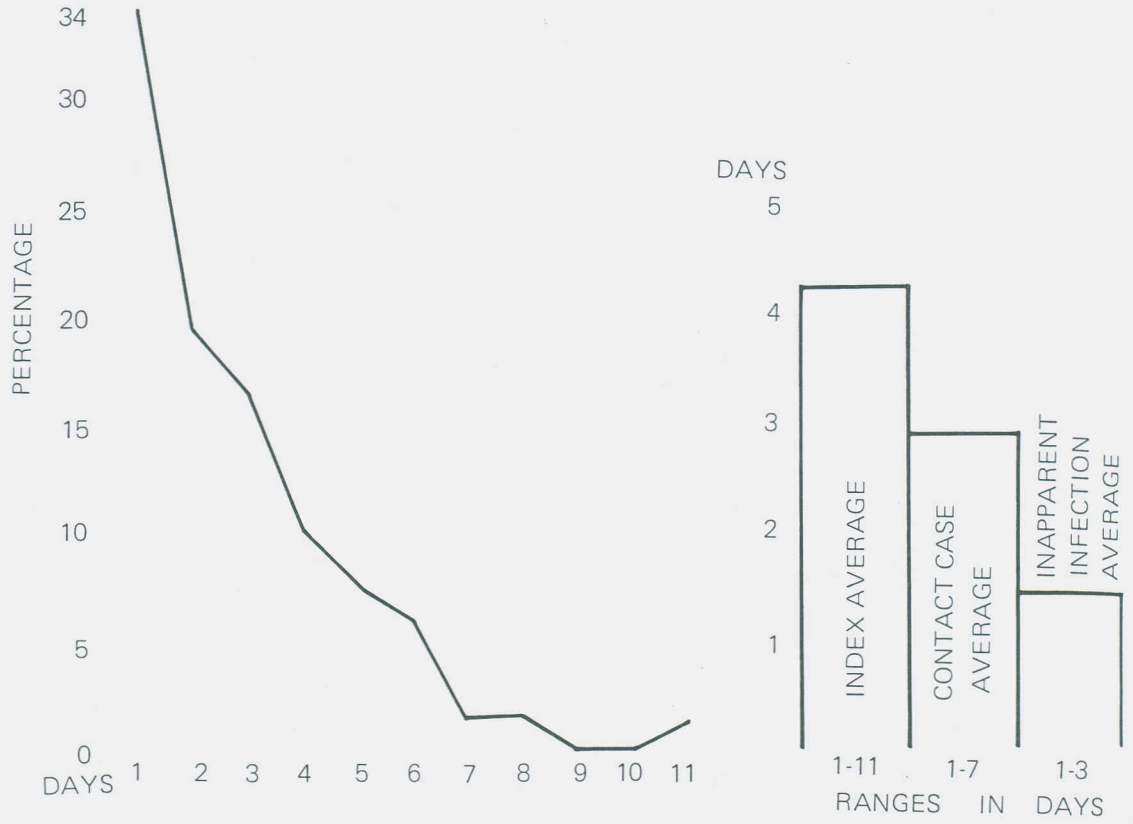

Figure 1. Duration of Excretion of Vibrio

Table 4

Index-Specific Infection Rates: Contacts

Age/sex Index	Infn/100	Case/100
MALE 15+	6.3[a]	6.3[e]
Female 15+	44.4[b]	37.0[f]
Children up to 14	31.9[c]	24.0

a vs b = Significant
a vs c = Significant
e vs f = Not Significant

Table 4 shows the attack rates in small, medium and large families. These are 17, 42 and 34%, respectively. The differences are highly significant between the small and the medium groups. The differences in the rates of children of these families, up to the age of nine, are also highly significant.

Table 5 shows that where the index case is an adult male, the secondary infection and case rates are 6.3%; where the index case is an adult female, the rates are 44.4% and 37%; and where the index cases are children, the rates are 31.9% and 24.2%, respectively. These differences are significant.

Table 6 summarizes the findings of the past and present in the case of Classical and El Tor cholera cases. The main similarities with Classical cholera cases are in the rates in children, infection-to-case ratio, hospitalization rates and index-specific subsequent attack rates. The main differences with the former El Tor data are in secondary case rates, infection-to-case ratio, hospitalisation rates, multiple-case family rates and infection-to-hospitalization ratio.

Table 5

Summary of Past and Present Observations

	Past Classical up to 1968	Past El tor up to 1970	Present El Tor 1973
Secondary Infn. Rate	16.7%; 13.0%; 4.2%	24.0%	31.3%
Rate in Child up to 9 yrs.	30.3%	25.9%	40.7%
Second Case Rate	4.2%, 8.4%; 16.9%	6.6%	24.6
Infn. Case Ratio	2:1; 4:1	1:1; 36:1, 100:1	1.3:1
Hosp. Rate	6.2%, 9.9 %	1.2%	6.7%
Multi. Hosp. Case Family	10.6%	3.6%; 3.7%	20%
Index 15 + M	Infec. Rate Low	N.A.	6.3%
15 + F	Infec. Rate High	N.A.	44.4%
Child. < 15	Infec. Rate High	N.A.	31.9%
Infn. Hosp. Ratio	2.6:1; 4:3	17:1	4.7:1

DISCUSSION

Cholera caused by *Vibrio cholerae* biotype El Tor was thought to be milder (5) than Classical biotype, for a considerable time. This study shows that it is not at all mild in Dacca. In fact, the secondary infection rate, infection-to-case rate, infection-to-hospitalization ratio and multiple-case family rate were all higher than both Classical and El Tor biotype observed in the past. All of this suggests a change in virulence of this organism. In addition, this study reveals two more factors: (1) the age and sex of the first case of a family significantly influences the subsequent attack rates among the contacts, and (2) the contacts have over 600 times greater risk of being hospitalized with cholera than the population in general.

REFERENCES

1. Pak-SEATO CRL. Cholra in East Pakistan families, 1962-63 Bull. Wild. Hlth. Org. *32*:205-209, 1965.
2. Mosley, W.H., Ahmed, S., Beneson, A.S., Ahmed, A. Relationship of vibriocidal antibody titre to susceptibility to cholera in family contacts of cholera patients. Bull. Wild. Hlth. Org. *38*: 777-785, 1968
3. Oseason, O.R., Ahmed. S., Islam. M.A., Rahman, A.S.M.M.. Clinical and bacteriological findings among families of cholera patinets. Lancet 1 (7433): 340-342, 1966.
4. Khan, M.U., Mosley, W.H.. Contrasting epidemiologic pattern of diarrhea and cholera in a semi-urban community. Jour. Pak. Med. Assn., *14*: 380-385, 1969.
5. Bart, J.K., Huq, Zahidul, Khan, M.U., & Mosley, W.H.. Seroepidemiologic studies during a simultaneous epidemic of infection with El Tor Ogawa and Classical Inaba *Vibrio cholerae*. Jour. Infect. Dis. *121*: suppl. 17-24, 1970
6. Martin, A. R., Mosley, W.H., Sau, B.B., Ahmed, S., Huq, I. Epidemiologic analysis of endemic cholera in urban East Pakistan, 1964-66. Am. J. Epid., *89*: 572-582, 1969.
7. Dizon, J.J. M.G. Alvero, P.R. Joseph, J.F. Tamayo, W.H. Mosley, and D.A. Henderson. Characteristics of cholera El Tor in Negros Occidental Province, November, 1961–September, 1962. Bull. Wld. Hlth. Org. *33*: 627-636, 1965.
8. Van de Linde, P.A. M. and Forbes, G.I. Observations on the spread of cholera in Hong Kong 1961-1963, Bull. Wld. Hlth. Org. *32*: 515-530, 1965.
9. Yen, C.H. A recent sutdy of cholera with reference to an outbreak in Taiwan in 1962. Bull. Wld. Hlth. Org. *30*:811-825, 1964.

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